US005580177A

United States Patent [19]

Gase et al.

[11] Patent Number: 5,580,177

[45] Date of Patent: Dec. 3, 1996

[54] **PRINTER/CLIENT NETWORK WITH CENTRALLY UPDATED PRINTER DRIVERS AND PRINTER STATUS MONITORING**

[75] Inventors: **Stephen T. Gase; Craig R. White**, both of Boise, Id.

[73] Assignee: **Hewlett-Packard Company**, Palo Alto, Calif.

[21] Appl. No.: **220,322**

[22] Filed: **Mar. 29, 1994**

[51] **Int. Cl.**[6] **G06F 15/16**

[52] **U.S. Cl.** **400/61**; 395/114

[58] **Field of Search** 400/61, 70, 76; 395/112, 114

[56] **References Cited**

U.S. PATENT DOCUMENTS

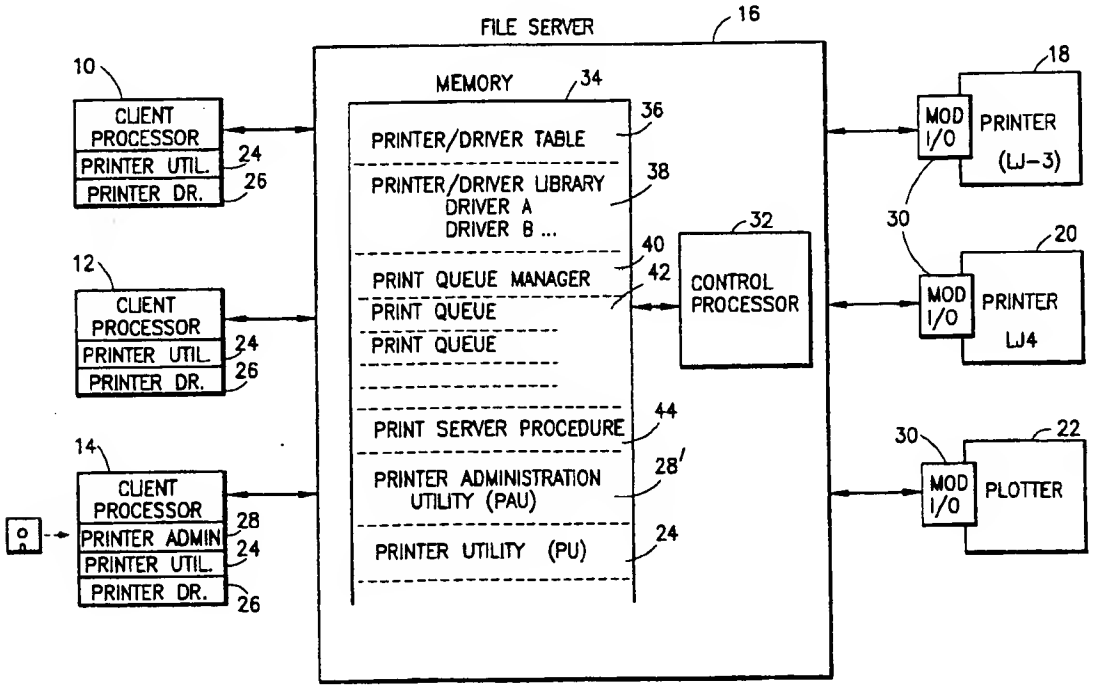
4,860,110	8/1989	Kokubo	395/112
4,968,159	11/1990	Sasaki	395/112
5,014,221	5/1991	Mogul	395/113
5,025,398	6/1991	Nelson	395/112
5,123,757	6/1992	Nagaoka	395/114
5,165,014	11/1992	Vassar	395/112
5,195,130	3/1993	Weiss et al.	379/98
5,228,118	7/1993	Sasaki	395/112
5,268,993	12/1993	Ikenoue	395/114
5,287,194	2/1994	Lobiondo	395/114
5,303,336	4/1994	Kageyama	395/112
5,392,419	2/1995	Walton	395/112
5,493,408	2/1996	Kurogane et al.	395/114
5,533,174	7/1996	Flowers, Jr. et al.	395/114
5,533,175	7/1996	Lung et al.	395/115

Primary Examiner—Edgar S. Burr
Assistant Examiner—Steven S. Kelley

[57] **ABSTRACT**

A network includes plural client processors, a file server and plural printers. Each client processor has memory that stores a printer driver procedure which enables the client processor to interface with at least one printer type. The file server includes memory for storing a most updated printer driver procedure for each printer type coupled to the file server. The file server is responsive to a print request from a client processor to assign a printer to the requesting client processor. The file server then in combination with the client processor determines if a printer driver procedure for the assigned printer in the client processor is identical to a most updated printer driver procedure stored in memory in the file server. If not, the file server enables alteration of the printer driver procedure in the client processor to bring it into coincidence with the most updated print driver procedure. A printer utility is also installed in each client processor and provides the means for automatically determining network status and for indicating to the user whether the network is available or unavailable, and a message indicating the reason for the unavailability.

7 Claims, 6 Drawing Sheets



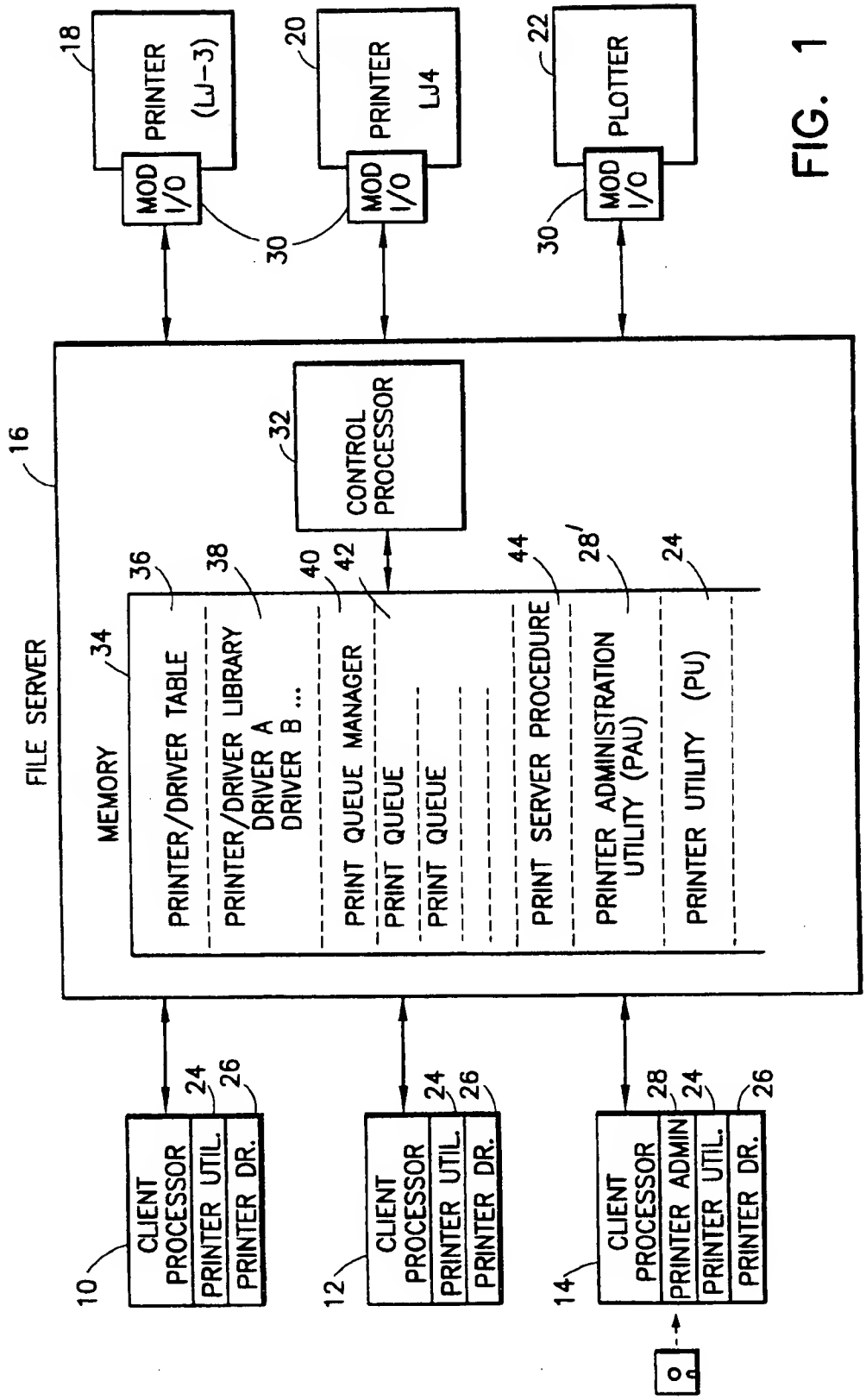
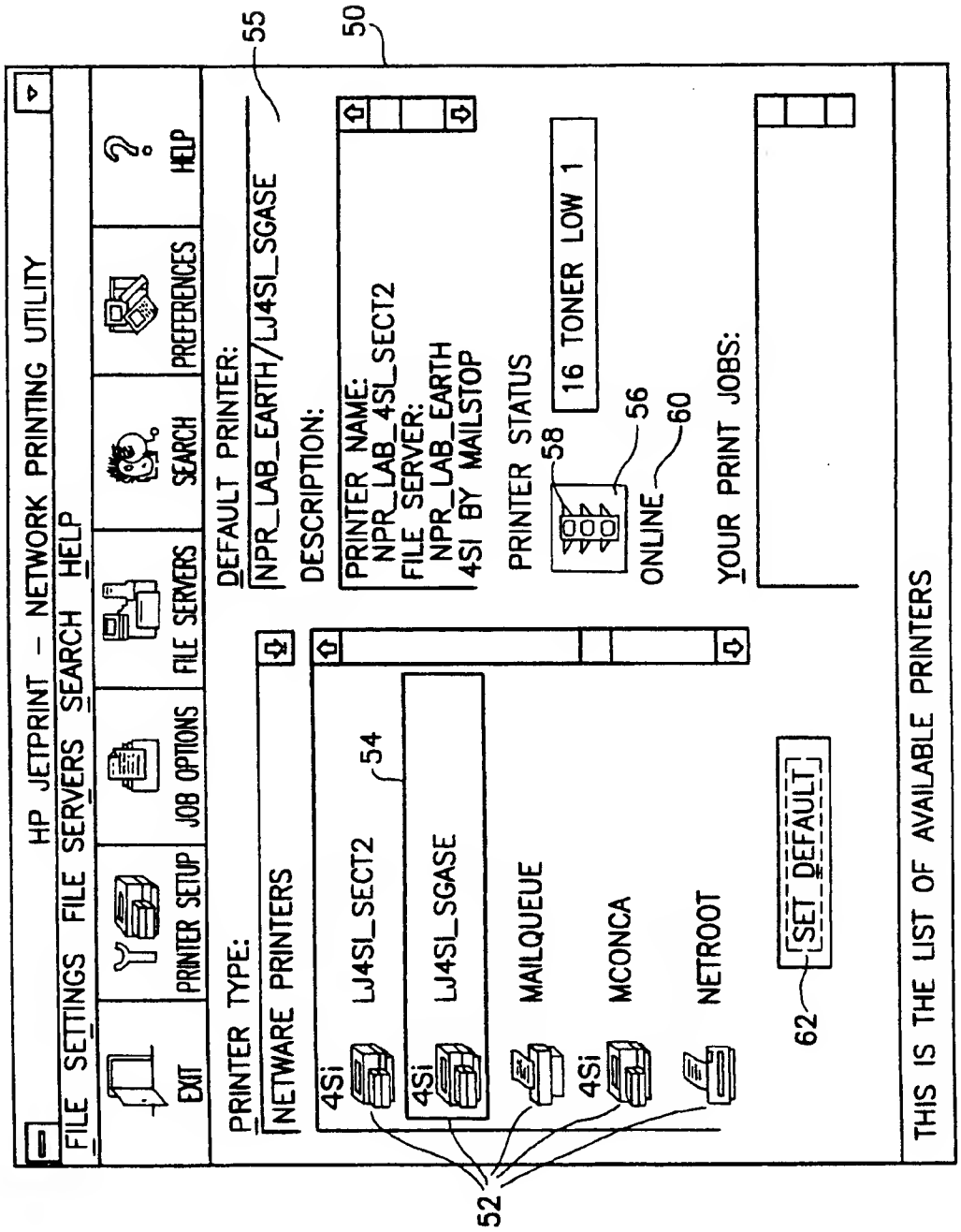

18
PRINTER (LJ-3)
MOD I/O
20
PRINTER LJ4
MOD I/O
22
PLOTTER
MOD I/O
30
30
16
FILE SERVER
32
CONTROL PROCESSOR
MEMORY
34
36
PRINTER/DRIVER TABLE
38
PRINTER/DRIVER LIBRARY
DRIVER A
DRIVER B ...
40
PRINT QUEUE MANAGER
42
PRINT QUEUE
PRINT QUEUE
44
PRINT SERVER PROCEDURE
28'
PRINTER ADMINISTRATION UTILITY (PAU)
24
PRINTER UTILITY (PU)
10
CLIENT PROCESSOR
PRINTER UTIL.
PRINTER DR.
24
26
12
CLIENT PROCESSOR
PRINTER UTIL.
PRINTER DR.
24
26
14
CLIENT PROCESSOR
PRINTER ADMIN
PRINTER UTIL.
PRINTER DR.
28
24
26

FIG. 1

FIG. 2


HP JETPRINT – NETWORK PRINTING UTILITY
FILE SETTINGS FILE SERVERS SEARCH HELP
EXIT
PRINTER SETUP
JOB OPTIONS
FILE SERVERS
SEARCH
PREFERENCES
HELP
55
50
DEFAULT PRINTER:
NPR_LAB_EARTH/LJ4SL_SGASE
PRINTER TYPE:
NETWARE PRINTERS
DESCRIPTION:
PRINTER NAME:
NPR_LAB_4SL_SECT2
FILE SERVER:
NPR_LAB_EARTH
4SI BY MAILSTOP
PRINTER STATUS
16 TONER LOW 1
58
56
ONLINE
60
YOUR PRINT JOBS:
4Si
LJ4SL_SECT2
54
4Si
LJ4SL_SGASE
MAILQUEUE
4Si
MCONCA
NETROOT
SET DEFAULT
62
52
THIS IS THE LIST OF AVAILABLE PRINTERS

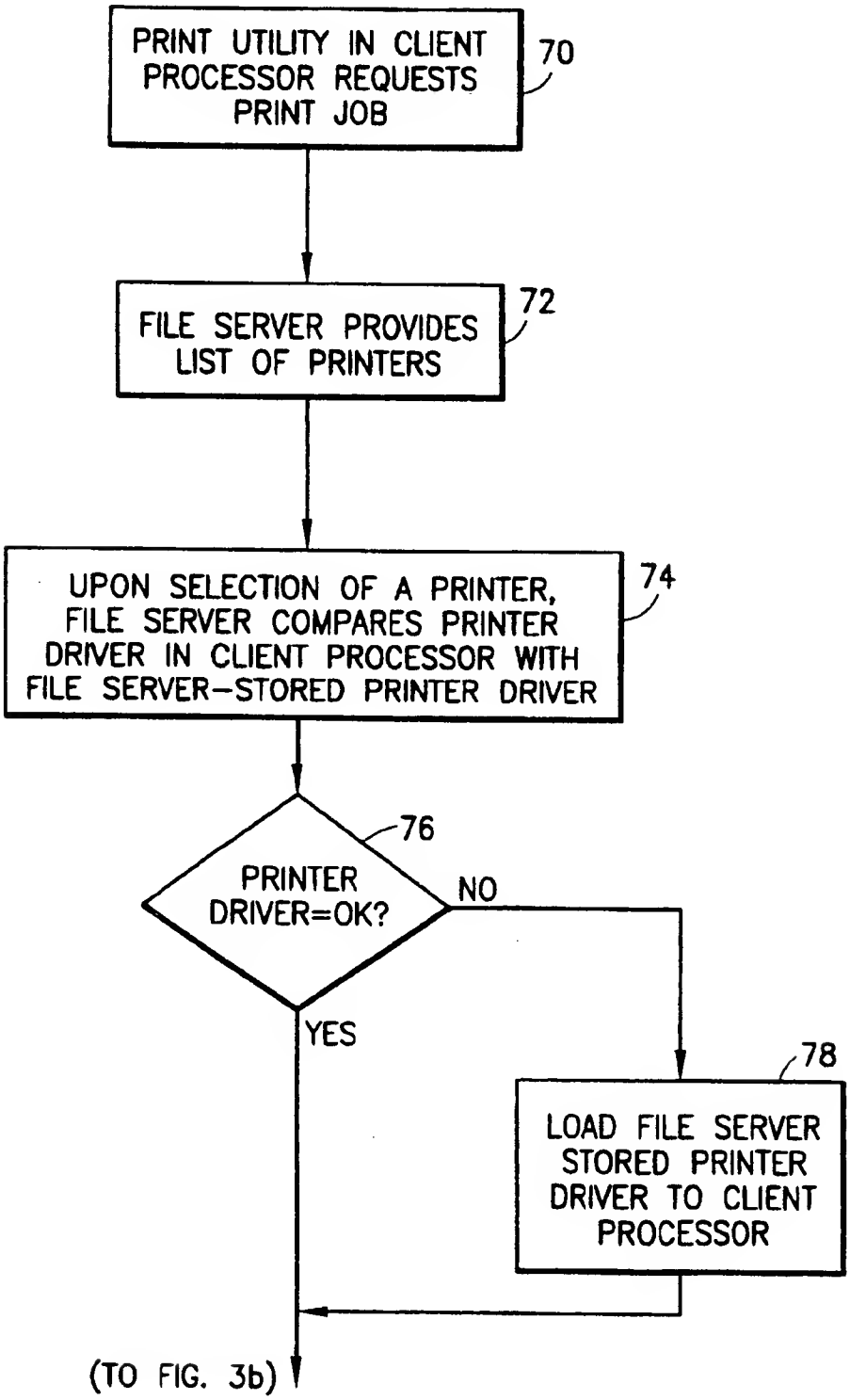

PRINT UTILITY IN CLIENT PROCESSOR REQUESTS PRINT JOB
70
FILE SERVER PROVIDES LIST OF PRINTERS
72
UPON SELECTION OF A PRINTER, FILE SERVER COMPARES PRINTER DRIVER IN CLIENT PROCESSOR WITH FILE SERVER–STORED PRINTER DRIVER
74
PRINTER DRIVER=OK?
76
NO
YES
LOAD FILE SERVER STORED PRINTER DRIVER TO CLIENT PROCESSOR
78
(TO FIG. 3b)

FIG. 3a

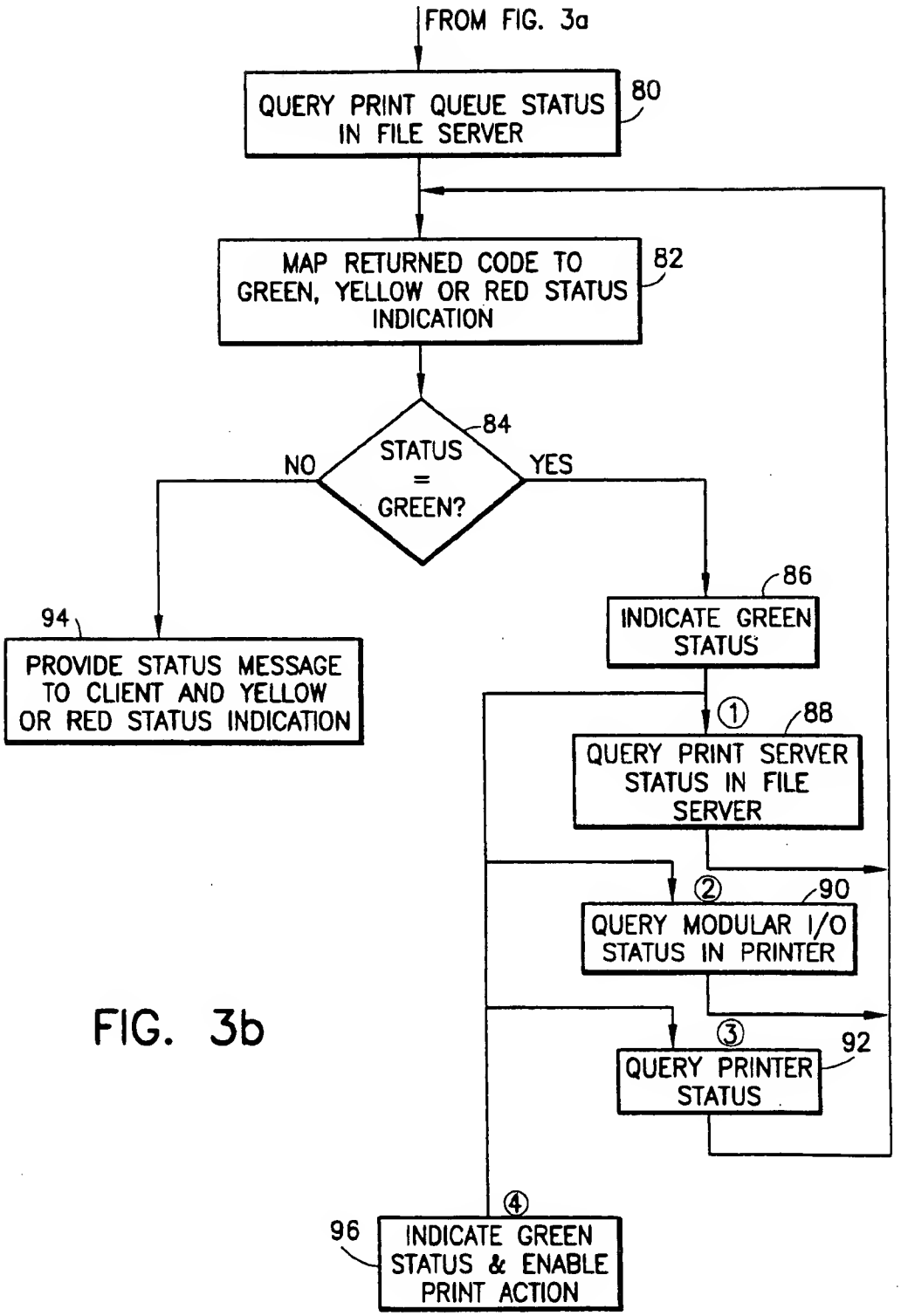

FROM FIG. 3a
QUERY PRINT QUEUE STATUS IN FILE SERVER
80
MAP RETURNED CODE TO GREEN, YELLOW OR RED STATUS INDICATION
82
STATUS = GREEN?
84
NO
YES
94
PROVIDE STATUS MESSAGE TO CLIENT AND YELLOW OR RED STATUS INDICATION
86
INDICATE GREEN STATUS
①
88
QUERY PRINT SERVER STATUS IN FILE SERVER
②
90
QUERY MODULAR I/O STATUS IN PRINTER
③
92
QUERY PRINTER STATUS
④
96
INDICATE GREEN STATUS & ENABLE PRINT ACTION

FIG. 3b

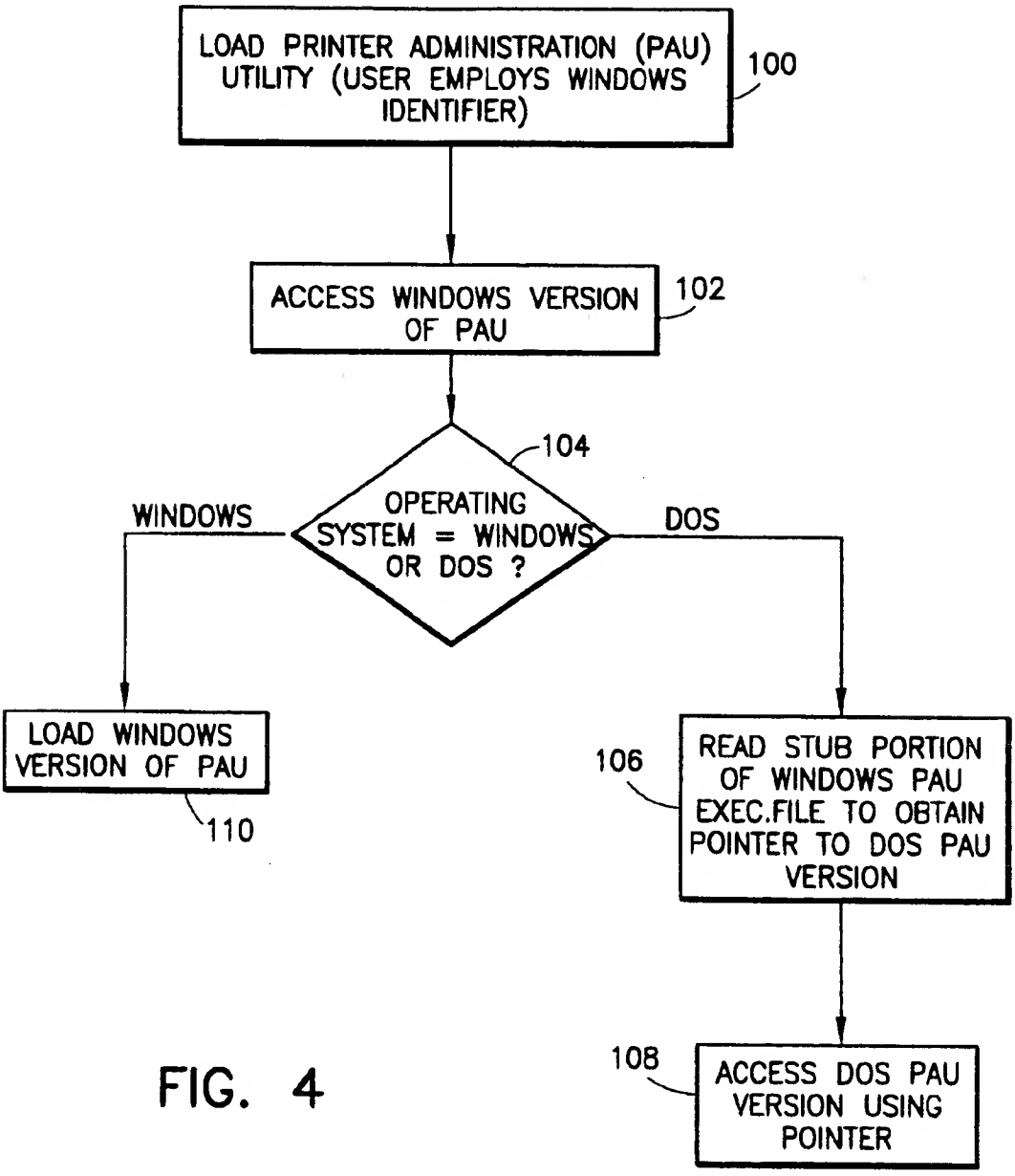

LOAD PRINTER ADMINISTRATION (PAU) UTILITY (USER EMPLOYS WINDOWS IDENTIFIER)
100
ACCESS WINDOWS VERSION OF PAU
102
104
OPERATING SYSTEM = WINDOWS OR DOS ?
WINDOWS
DOS
LOAD WINDOWS VERSION OF PAU
110
106
READ STUB PORTION OF WINDOWS PAU EXEC.FILE TO OBTAIN POINTER TO DOS PAU VERSION
108
ACCESS DOS PAU VERSION USING POINTER

FIG. 4

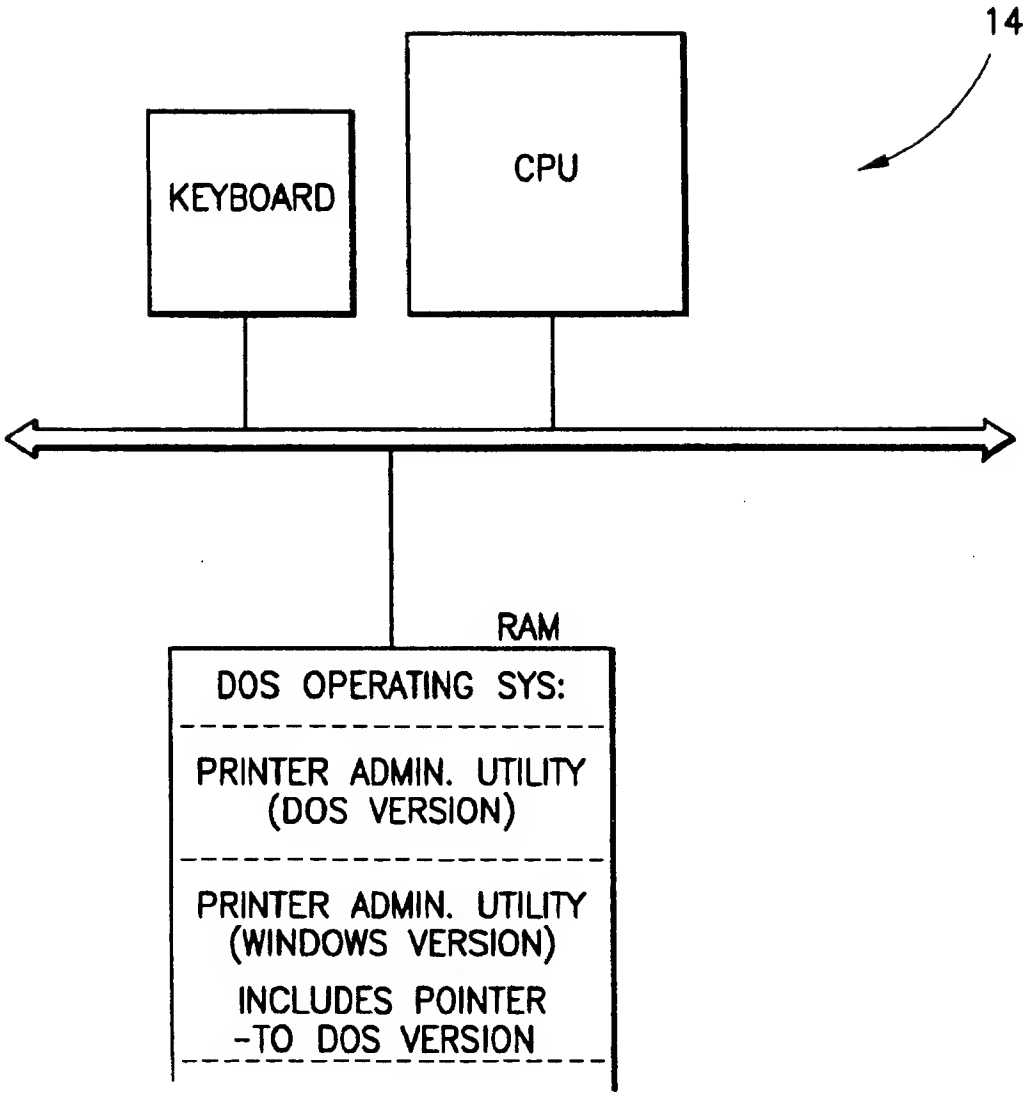

14
KEYBOARD
CPU
RAM
DOS OPERATING SYS:
PRINTER ADMIN. UTILITY (DOS VERSION)
PRINTER ADMIN. UTILITY (WINDOWS VERSION)
INCLUDES POINTER -TO DOS VERSION

FIG. 5

PRINTER/CLIENT NETWORK WITH CENTRALLY UPDATED PRINTER DRIVERS AND PRINTER STATUS MONITORING

FIELD OF THE INVENTION

This invention relates to printers that are connected to a network and are accessible from a plurality of client processors via a file server and, more particularly, to such a network wherein printer driver procedures installed in client processors are centrally available from a most-updated version of the printer driver procedure and, further, wherein the client processors are continuously informed of a printer's availability status.

BACKGROUND OF THE INVENTION

The most widely used operating systems in desktop computers are DOS (Disk Operating System) and Windows, both products of the Microsoft Corporation, Redmond, Washington. The DOS operating system requires that applications include an embedded printer driver module that enables communications with a connected printer. An application, therefore, must have embedded in it an appropriate printer driver for a connected printer. If two or more printers of different kinds are connected to a computer having DOS applications, each application requiring use of the printers must include embedded printer drivers for each printer type. By contrast, the Windows operating system employs separate printer driver modules and all applications written for a Windows operating system are enabled to employ a printer driver module in a generic manner. Thus, Windows applications have a standard interface that matches the preexisting printer driver module. If a computer is required to interface with two or more different types of printers, each requiring a separate printer driver, the Windows operating system will require a printer driver module for each of the different type printers.

In a network environment where multiple client computers are connected via a file server or interconnecting network to multiple printers, a number of administrative problems arise that are not present when a single computer is connected to a single printer. For instance, if a new printer type is added to a site, each client computer must be informed of the network configuration change and a new printer driver must be installed on the client computer for the device. Otherwise, the client computer is not able to use the newly added printer. Further, as new printer drivers are provided by manufacturers to correct previously discovered defects or to provide enhancements to previous printer drivers, each client computer must receive a new printer driver. These actions can cause substantial network interruption while the new printer drivers are being installed.

In a network of the nature described above wherein client computers employ the Windows operating system, a separate file server installation is often used to enable communications between the client computers and network-connected printers. In order to determine network print function availability, a user of a client computer must have detailed information regarding precisely where to inquire to access network status information. In a network operating under the NetWare environment (Novell Corporation, Provo, Utah), there are many pieces of status information that, together, affect an overall print operation. For instance, the Novell print server and queue management system both evidence status information regarding printer availability; however, their status information can only be accessed by knowing where (and how) to inquire. Further, even if the user knows how to obtain network status information, it is up to the user to understand the meaning of the status information.

Client computers connected to a printer network employ a software utility to control interface functions with a connected file server. The file server, in turn, enables access to various printers connected in the network. Such a software utility often can only run in a single operating system environment, i.e., DOS, Windows, OS/2, etc. When there is a requirement that such a software utility operate with more than one operating system environment, the traditional solution has been to develop to separate utilities, each with a different name, and method to invoke. For instance, if a client computer has both DOS and Windows, the client computer includes a printer utility written specifically for DOS and one specifically written for Windows. The user must thus remember the name of the printer utility written for the operating system the client computer is running under.

Accordingly, it is an object of this invention to provide a network that includes multiple printers and client computers, wherein a file server is included that allows central administration and updating of printer driver installations.

It is a further object of this invention to provide an improved printer/client computer network where information is continuously provided regarding network status so as to enable a user to assess an ability to accomplish a print job.

It is still another object of this invention to provide an improved system for insuring that a proper printer utility will be loaded in a client computer even if the wrong printer utility is requested by the user.

SUMMARY OF THE INVENTION

A network includes plural client processors, a file server and plural printers. Each client processor has memory that stores a printer driver procedure which enables the client processor to interface with at least one printer type. The file server includes memory for storing a most updated printer driver procedure for each printer type coupled to the file server. The file server is responsive to a print request from a client processor to assign a printer to the requesting client processor. The client processor then determines if a printer driver procedure for the assigned printer in the client processor is identical to a most updated print driver procedure stored in memory in the file server. If not, the client processor causes alteration of is printer driver procedure to bring it into coincidence with the most updated print driver procedure. A printer utility is also installed in each client processor and provides the means for automatically determining network status and for indicating to the user whether the network is available or unavailable, and a message indicating the reason for the unavailability.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram of a system incorporating the invention.

FIG. **2** is a representative display that appears on the screen of a client processor.

FIGS. **3***a* and **3***b* illustrate a logical flow diagram of the operation of one aspect of the invention.

FIG. **4** is a logical flow diagram illustrating the operation of a further aspect of the invention.

FIG. **5** is a block diagram illustrating the system that performs the process described in FIG. **4**.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1, client processors **10**, **12** and **14** are connected, via an intervening network, to a file server **16**. A plurality of printers **18**, **20**, **22** are also connected to file server **16** and are made available for use by any of client processors **10**, **12** or **14** through the action of file server **16**. Each client processor includes a printer utility program **24** which allows a user to select a printer connected to file server **16** (e.g., printer **18**, printer, **20**, etc.) as a default printer without the user needing to know any of the network interactions that are required to establish connection with the printer. Thus, any time a user executes a print command from a client processor, printer utility **24** automatically makes connection with the default printer.

Hereafter, it will be assumed that each of client processors **10**, **12**, **14** employs the Windows operating system. Client processors **10**, **12**, **14** further include a printer driver procedure **26** that enables a client processor to configure an output data stream that will be recognized and operated upon by a connected printer. The output data stream implements necessary hand-shaking actions required to enable interaction between the client processor and the connected printer. One client processor, in this case client processor **14**, is designated as a network administrator and includes a printer administration utility program **28** which enables uploading of new programs into file server **16**.

printers **18** and **20** are provided with modular input/output (I/O) plug-in cards **30**. A similar modular I/O plug-in card **30** is provided for plotter **22**. Each modular I/O card **30** is provided with a microprocessor and a shared memory through which data is provided to a connected printer/plotter. A modular I/O card **30** provides interface capability between a connected printer/plotter and file server **16**. A modular I/O card **30** includes all network protocol information required to establisb a connection and operate over the network created by file server **16**, and to enable print jobs to be received and transmitted. The I/O function is configured on a pluggable card for the reason that printers, **18** and **20**, and plotter **22** may be connected to any of a plurality of networks, each such network baving a unique network protocol. By enabling I/O functions to be handled by a modular I/O card, a printer or plotter may be interfaced with any of the plurality of networks—so long as the proper modular I/O card **30** is inserted. Such a modular interface function is described in U.S. Pat. No. 5,197,128 to Campbell et al. which is assigned to the same Assignee as this application. The disclosure of U.S. Pat. No. 5,197,128 is incorporated berein by reference.

File server **16** provides a central control function whicb enables one or more of client processor **10**, **12**, **14** to be connected to one or more printers **18**, **20** or to plotter **22**. Within file server **16** is a control processor **32** tbat operates file server **16** and its interconnection functions. A memory **34** in file server **16** stores a plurality of data structures that are necessary for the operation of the client processor/printer network. One such data structure is a printer/driver table **36** which contains a listing that associates each printer connected to file server **16** with a printer driver procedure for the printer. Data from printer/driver table **36** is used to access a printer driver procedure stored in printer/driver library **38**. It is to be understood that a number of different types of printers are connectable to file server **16**. For instance, printer **18** is a LaserJet III model manufactured by the assignee hereof whereas printer **20** is a LaserJet IV model. Different printer drivers are required for each of the aforesaid models. A printer driver procedure for each is stored in printer/driver library **38**.

Memory **34** further contains a print queue manager procedure **40** which receives print jobs and print job requests from connected client processors and places them in one or more of print queues **42**. When a printer is prepared to receive a new print job, it notifies a print server procedure **44** which then arranges to feed a print job to the connected printer from one of print queues **42**.

Also contained within memory **34** is a most updated version **28'** of printer administration utility program **28** and updated version **24'** of printer utility program **24**. Because memory **34** stores (i) most updated versions of printer drivers in printer/driver library **38** (ii) printer administration utility **28** and (iii) printer utility **24**, there always exists a repository where the most updated version of a program can be found. Thus, when a client processor elects to utilize a particular printer, it further determines whether its printer driver **26** is consistent with the most updated printer driver version in printer driver library **38**. If not, the client processor causes its printer driver **26** to be revised or overwritten to reflect the most updated printer/driver version contained within printer driver library **38**. Likewise, if any changes are made to printer administration utility **28** or printer utility **24**, the changed program version **24'**, **28'** merely needs to be loaded into memory **34** and then downloaded into all client processors **10**, **12** and **14**, as needed.

As above indicated, printer administration utility **28** is present in only one client processor (e.g., processor **14**), which acts as an overall system administrator. The printer administration utility **28** enables a printer driver, for instance, to be loaded onto client processor **14** and then uploaded into printer/driver library **38**. Furthermore, printer administration utility **28** enables printer/driver table **36** to be updated to reflect the newly inserted data.

printer administration utility **28**, among other functions, enables the file server **16** to indicate to eacb client processor a list of available printer/plotters found on the network.

Each modular I/O card **30** periodically "advertises" its availability by the transmission of messages to file server **16**. Each message includes the name of the service, the type of service and the address of the available service (e.g. print actions). This data is accumulated within file server **16** and enables the generation of display presentation **50** (see FIG. 2) at a client processor. Display screen presentation **50** appears on a client processor in response to a user's request to sbow available printers. Screen presentation **50** is presented under control of printer utility **24** which initially determines a default printer destination and sbows the name and states for that printer at **55** and **58** respectively in presentation **50**. Printer utility **24** then examines the printer/driver table **36** contained in file server **16** for the matching printer driver. If the existing driver in the client processor requires an update, the new printer driver is reinstalled. Screen presentation **50** at location **52** shows a list of other potential printers that are available to the client processor. By a user selecting one of the entries in the list by movement of selection bar **54**, status indicator **58** and status message **60** are updated to reflect the status of the selected printer.

Selecting a SET DEFAULT button **62** will cause the highlighted entry to become the new default printer. The default printer is used by all Windows applications for printing documents. Printer utility **24** will also install a new and matching driver for this printer, obtained from the printer/driver database."

Upon the user selecting a particular printer by the movement of selection bar **54**, status box **56** automatically indi-

cates an availability status of the selected printer. The status is indicated by traffic light-like icon **58** which displays either red, yellow or green lights, depending upon the status of the selected printer and the intervening network. More particularly, when a user positions a cursor at a selected printer and performs a selection action, printer utility procedure **24** enables automatic connection to file server **16** and to an appropriate print queue **42** which serves the selected printer. At the same time, printer utility procedure **24** gathers status information with respect to print queue **42**; print server procedure **44**; modular I/O card **30**; and its connected printer (e.g., printer **20**). The status data is accumulated in the aforesaid order and if, at any time, a status of a system entity is found to be other than available (i.e., "green"), a message is immediately generated and displayed location **60** on presentation **50** to inform the user that a print action is not immediately available upon the selected printer and, the reason why. At such time, icon **58** displays either a yellow or red light, depending upon the particular status condition.

The automated status response relieves the user from having to know where to inquire to find status information from each of the subsystems that are critical to the performance of a print job. As multiple status messages are available, a hierarchy is used to determine which status message to display. First the print queue status is determined; then the print server procedure status; then the modular I/O status; and finally the printer status. When a first status indication is found that gives rise to a "red" or "yellow" indication, that status controls which message is presented to the user at the client processor. If all status conditions are "green", the print action is enabled.

The following is a partial list of system conditions for which green, yellow and red manifest at status window **56**.

Print queue status:

green condition: queue active and available;

yellow condition: print job can not be serviced;

red conditions; cannot add jobs; queue status error.

Print server status:

green conditions: waiting for jobs; printing;

yellow conditions: private; paused;

red conditions: waiting for form, stopped, ready to go down, not connected.

Modular I/O card status:

green conditions: busy; connected to file server.

yellow conditions: initializing interface; trying to connect to print server; trying to connect to file server; connecting to file server; print server requested disconnect.

red conditions: network protocol not configured; shutdown; unable to find print server; unable to connect to print server; printer number in use; printer number not defined, etc.

Printer status:

green conditions: printing test page; printing; online.

yellow conditions: warming up, resetting printer; output bin full; paper out; offline; toner low, etc.

red conditions: printer error; cover open; paper jam; no toner; not connected, etc.

A printer utility **24** in a client processor, by analyzing status responses returned from the above noted network subsystems, is able to compile a status response for the user. In fact, each subsystem returns a code value indicative of a particular condition status. Printer utility **24** includes a table which maps each possible returned code to a red, yellow or green status level. When other than a green status level results, a message is automatically displayed for the user indicating the particular status problem and a yellow or red light is displayed accordingly. At other times, a green light is displayed, indicating availability of the network and designated printer.

Turning now to the flow diagram of FIGS. **3***a* and **3***b*, the overall operation of the system of FIG. **1** will be described. Initially, a printer utility **24** in a client processor requests a print job from file server **16** (box **70**). In response, file server **16** provides the requesting client processor with a list of available printers (box **72**). Upon selection of a printer, the client processor causes file server **16**, via printer/driver table **36** and printer/driver library **38**, to compare the printer driver in library **38** with a printer driver **26** contained in the client processor (box **74**). If the compared printer drivers do not match (decision box **76**), an updated printer driver **26** is down-loaded into the client processor from printer/driver library **38** (box **78**). In this manner, it is assured that the requesting client processor contains most updated printer driver **26** for the requested printer.

If decision box **76** indicates that the printer drivers match, printer utility **24** requests status information from the printer to be connected and, intervening network subsystems. Initially, printer utility **24** queries the status of a print queue **46** for the selected printer (box **80**). In response, file server **16** passes a status message back to printer utility **24** indicating the status of the interrogated print queue **42**. Printer utility **24** then maps the returned status code to either a green, yellow or red state (box **82**). If the status code maps to a green state (decision box **84**), a green status is indicated (box **86**) and print server procedure **44** is queried to determine its status (box **88**). The returned status code from print server procedure is mapped to the green, yellow or red state and if the status code maps to a green state (decision box **84**), the same procedure occurs with respect to the status code returned from modular I/O card **30** in a selected printer (box **90**) and then, if a green status is indicated, with respect to the status of the printer itself (box **92**). If at any time during the above query actions, decision box **84** indicates that the status is other than green, a yellow or red status indication is manifest on a client processor's display and a status message is presented which indicates the particular problem (box **94**). At this stage, the user has the ability to change printer selection, whereupon printer utility **24** commences a new series of status inquiries. If all status inquiries indicate green, then the green state is indicated upon the display (box **96**) and the print action may continue.

Through the actions of printer utility **24** and printer administration utility **28**, a client processor is assured of always having access to a most updated printer driver **26** for a selected printer. Furthermore, the user is immediately presented with a status message indicating the availability (or unavailability) of a selected printer without the user having to sequentially inquire into the status of intervening subsystems within the network.

The system, as described above, has been assumed to be operating in a Windows operating system environment. However, it may be the case that one or more client processors are running under a DOS operating system. To accommodate the possibility that client processor **14** (chosen to be the system administration processor) is operating under DOS, printer administration utility **28** is loaded onto client processor **14** in both DOS and Windows versions (see FIG. **5**). In the prior art, if a user of client processor **14** (running under DOS) mistakenly entered the name of the Windows version of printer administration utility **28**, an error message would be displayed indicating that printer administration utility **28** can only be run on a printer running the Windows operating system. This error message would have been contained in a "stub" portion of the Windows execution file

of printer administration utility **28**. That error message, in the prior art, would provide no indication to the user of where the DOS version of the printer administration utility **28** could be found.

Instead, of placing an error message in the stub portion, of the Windows execution file, the stub portion is caused to contain a pointer to the DOS version of printer administration utility **28**. Thus, if the Windows file name is mistakenly entered by the user (and the client processor is running under DOS), the Windows execution file accesses its stub portion and, under control of the pointer to the DOS printer administration utility file, issues a call to the DOS printer administration file, enabling it to be loaded in RAM within client processor **14**.

This procedure is illustrated in FIGS. **4** and **5** wherein a load printer administration utility using an incorrect Windows file name is given by the user (box **100**). As a result, the client processor accesses the Windows version of the printer administration utility (box **102**). If the processor is operating in a DOS environment (decision box **104**), the stub portion of the Windows printer administration utility execution file is read to obtain a pointer to the stored DOS printer administration utility (box **106**). That version is then accessed (box **108**) and stored in RAM to be ready for execution (box **108**). If the client processor is running under Windows, then the Windows' version of the printer administration utility is loaded, as per normal (box **110**).

It should be understood that the foregoing description is only illustrative of the invention. Various alternatives and modifications can be devised by those skilled in the art without departing from the invention. Accordingly, the present invention is intended to embrace all such alternatives, modifications and variances which fall within the scope of the appended claims.

What is claimed is:

1. A network including a file server with plural client processors and plural printers connected to said file server via a network path, said network comprising:

memory in each client processor for storing a printer driver procedure that enables communication between said client processor and at least one type printer;

memory in said file server for storing a library of most-updated printer driver procedures for each specific printer type of said plural printers, each printer driver procedure enabling a client processor to configure an output data stream that is recognized and operated upon by a specific printer type; and

processor means in said file server, responsive to a print message from a requesting client processor, to enable assignment of a printer of said one type to said requesting client processor, said processor means in combination with said requesting client processor further determining if said printer driver procedure for said printer of said one type stored in said requesting client processor is identical to a printer driver procedure for a printer of said one type stored in memory of said file server and, and in response to non-identical printer driver procedures, causing alteration of said printer driver procedure in said requesting client processor to bring said printer driver procedure into coincidence with said most updated printer driver procedure for the printer of said one type.

2. The network as recited in claim **1** wherein said processor means enables assignment of a different printer type other than said one type to said requesting client processor and, upon determining an absence of a printer driver procedure for said different printer type in said requesting client processor, downloading to said requesting client processor from said library, a most updated printer driver procedure for said different printer type.

3. The network as recited in claim **1**, wherein said memory in said requesting client processor includes a printer utility procedure which, in combination with said processor means in said file server, enables said requesting client processor to present to a user, a listing of printers on said network.

4. The network as recited in claim **3** wherein said printer utility procedure, in combination with said client processor and in response to a user's selection of a printer from said listing, provides a user-visible status level indication that informs the user of availability of said printer selected from said listing.

5. The network as recited in claim 4 wherein said status level indication further informs the user of a status of a network component if said network component indicates a status that prevents use of said printer selected from said listing.

6. The network a recited in claim **5** wherein said network components include a print queue in said memory of said file server, a print server procedure operating in said file server, input/output interface means associated with said selected printer, and said selected printer.

7. The network as recited in claim **6** wherein a status level is determined for each said network component in sequence, and wherein a first status level determined for a network component that prevents use of said printer selected from said listing, controls said user-visible status level indication on said client processor.

* * * * *